

REMARKS

Overview

In the Office Action under reply ("Action"), claims 1-36 were examined. The claims stand rejected as follows:

(1) claims 1-36 are rejected under 35 U.S.C. §102(b) as anticipated by, or in the alternative, under 35 U.S.C. §103 as obvious over applicants admissions;

(2) claims 1-36 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement;

(3) claims 1-36 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement;

(4) claims 1, 4-6, 11, 13-18, 21-25, 27, 32, and 36 are rejected under 35 U.S.C. §103 as unpatentable over US 5,653,951 to Rodriguez ("Rodriguez") in view of Inagaki et al., (2001), *Determining Factors for the Intercalation into Carbon Materials from Organic Solutions*, 39 Carbon 1083 ("Inagaki");

(5) claim 26 is rejected under 35 U.S.C. §103 as unpatentable over Rodriguez in view of Inagaki, and further in view of Janot et al. (2001), *Ball Milling: A New Route for the Synthesis of Superdense Lithium GICs*, 39 Carbon 1931 ("Janot"); and

(6) claims 2-3, 8, 19-20, 29, and 34-35 are rejected under 35 U.S.C. §103 as unpatentable over Rodriguez in view of Inagaki and further in view of Chen et al., (1999), High H₂ Uptake by Alkali-Doped Carbon Nanotubes Under Ambient Pressure and Moderate temperatures, *Science*, 285, 91 ("Chen").

In addition, claims 7, 9-10, 12, 28, 30-31, and 33 are objected to for depending upon a rejected claim.

The rejections and objections are overcome in part by the amendments made herein, and are otherwise traversed for at least the reasons set forth below.

Claim amendments

With the amendments made herein, claims 1, 16, and 36 are amended to incorporate elements that can be found, for example, in paragraph [00028] of the original specification. Claims 4 and 5 have been amended to specify that the pillared carbon materials are prepared from one or a combination of materials; this amendment is supported, for example, by paragraph

[00033] in the original specification. In addition, claim 37-43 are newly added. Support for claims 37-42 can be found, for example, in paragraph [00028] of the original specification, as well as the originally filed claims. Support for claim 43 can be found, for example, in original claims 1 and 9. No new matter is added by these claims.

Information Disclosure Statement

Applicants regret that a Supplemental Information Disclosure Statement (IDS) was not attached to the previous response. Applicants attach hereto a Supplemental IDS listing the document cited in the previous response, as well as additional documents cited hereinbelow.

Rejection under 35 U.S.C. §102(b) or §103(a) over applicants' admissions

Claims 1-36 stand rejected under 35 U.S.C. §102(b) as anticipated by, or in the alternative, under 35 U.S.C. §103 as obvious over applicants' admissions. This rejection is traversed.

The Action mischaracterizes statements made in applicants response dated May 23, 2007 ("the May 23 response"). The Action provides, *inter alia*, the following quote from the May 23 response:

The methods and compositions of the instant application rely on synthetic procedures that are well known in the art, but had not been used as described in the specification prior to the filing date of the application. The fact that "a number of techniques or steps may be utilized" does not diminish from the fact that such techniques or steps are: (a) known in the art; and/or (b) described in the specification.

(Action at 3, emphases added in Action). Two other paragraphs are similarly identified in the Action. The Action appears to isolate and interpret the phrase "well known in the art" as an admission that the claimed invention is well known in the art. Such interpretation is in error, and indicates that the phrase "well known in the art" has been taken out of context. In fact, when interpreted in the correct context (i.e., when applicants' prior statements are read in their entirety), applicants did not state that the claimed invention is well known in the art, but that certain synthetic procedures that may be used to prepare the claimed compositions and/or practice the claimed methods are well known in the art. The crux of the arguments set forth in the May 23 response is that well known synthetic reactions can be used in various combinations and with various materials in order to provide completely novel materials and methods. It has

been recognized for decades that all inventions are combinations and/or variations of known methods and components. "As stated by Judge Learned Hand in *B.G. Corp. v. Walter Kidde & Co.*, 26 USPQ 288 (2d Cir. 1935):

All machines are made up of the same elements; rods, pawls, pitmans, journals, toggles, gears, cams, and the like, all acting their parts as they always do and always must. * * * But the elements are capable of an infinity of permutations, and the selections of that group which proves serviceable to a given need may require a high degree of originality."

(*Orthopedic Equip. Co., Inc. v. United States*, 205 USPQ 483, 485 (Ct. Cl. 1978)). If applicants were not allowed to use well established synthetic methods to arrive at novel and patentable inventions, the scope of patentable subject matter would be reduced so drastically as to be practically eliminated.

As a simple example, applicants mentioned Diels Alder reactions (see page 13 of the May 23 response) as a reaction that may be used in the preparation of the claimed compositions. The Diels Alder reaction is a reaction that is well known in the art. The fact that this is so, however, does not support the conclusion that all materials that may be prepared by the Diels Alder reaction (alone or in combination with other synthetic methods) are well known in the art. A cursory search of the USPTO patent database reveals that Diels Alder reactions continue to be frequently used to prepare novel and patentable materials.

In summary, applicants in the May 23 response did not admit that the claimed compositions and methods were known in the art, but rather that the synthetic methods that may be used to prepare the claimed compositions or practice the claimed methods are well known in the art. This argument particularly speaks to the rejection of the claims over non-enablement, as discussed herein below and in the May 23 response. Applicants' arguments in no way diminish patentability of the claimed inventions, as it is well established that patentable subject matter may be based upon known methods or components. Accordingly, applicants respectfully request withdrawal of the rejection.

Further claim rejections and objections

The Action expressly incorporates by reference all claim rejections and objections from the Non-Final Office Action dated 11/30/2006 (Action at p. 4). Applicants expressly incorporate herein by reference the remarks from the May 23 response. Applicants provide further discussion and evidence below.

Rejection under 35 U.S.C. §112, first paragraph

Claims 1-36 stand rejected under 35 U.S.C. §112, first paragraph, as “failing to comply with the enablement requirement” (Action dated 11/30/2006 at p. 3). This rejection is traversed.

Applicants attach hereto a Supplemental IDS citing four journal articles as evidence that the claimed materials and methods comply with the enablement requirement.

First, the Examiner's attention is called to Ma et al. (2005) *Inorganic Chemistry*, **44**(14):4912-4914 ("Ma"), in which is described the preparation of "a family of anisotropic, mixed-ligand, open-framework compounds featuring paddle-wheel-type coordination of Zn(II) pairs in two dimensions and pyridyl ligand pillaring in the third" (abstract, emphasis added). Ma reports the synthesis and characterization of pillared materials, and states that the family of compounds is suitable for gas storage applications (cols. 1-2, page 4912). The compounds are described as thermally stable - thermogravimetric analysis reveals that solvent loss is followed by framework decomposition at 380-400 °C. Gas adsorption experiments show that N₂ adsorbs in the permanently microporous materials. Synthetic procedures for preparing the materials in Ma consist of redox-, acid-base-, and/or ligation-type reactions. This article shows that the skilled artisan in 2005 was capable of practicing the claimed invention - i.e., preparing pillared carbon materials. This article further confirms that the methods suitable for making pillared carbon materials include well known reactions such as ligation-type reactions, which is entirely consistent with the instant application and claims. On the basis of this journal article alone, the rejection under 35 U.S.C. § 112, first paragraph, should be withdrawn.

Further evidence is provided by Chun et al. (2005), *Chem. Eur. J.*, **11**, 3521-3529 ("Chun"), in which is described the synthesis of a number of isomorphous analogues of the pillared material [Zn₂(1,4-bdc)₂(dabco)] (col. 2, p. 3522). Again, Chun uses well established reaction methods for preparing the pillared materials (e.g., solvothermal reactions - see col. 2, p. 3522). Again, the teachings of Chun are entirely consistent with the present application, and indicate that the skilled artisan would be capable of preparing the pillared materials of the instant claims using the guidance of the specification and well known synthetic reactions. Chun states that some attempts at preparing pillared materials were unsuccessful, but this is to be expected in any process involving synthetic chemistry. The skilled artisan would understand that a class of reactions or a methodology often works for many starting materials, but not for all starting

materials. In fact, as stated by MPEP 2164.08(b), inclusion of inoperative subject matter does not preclude enablement:

The presence of inoperative embodiments within the scope of a claim does not necessarily render a claim nonenabled. The standard is whether a skilled person could determine which embodiments that were conceived, but not yet made, would be inoperative or operative with expenditure of no more effort than is normally required in the art. *Atlas Powder Co. v. E.I. du Pont de Nemours & Co.*, 750 F.2d 1569, 1577, 224 USPQ 409, 414 (Fed. Cir. 1984) (prophetic examples do not make the disclosure nonenabling).

In the instant case, and as exemplified in Chun, no more effort than is normally required in the art would be sufficient to distinguish operative from inoperative embodiments of the claimed subject matter.

A further example of the preparation of pillared carbon materials using methods analogous to (or derivable from) those described in the instant specification is provided by Chen et al. (2007), *Inorganic Chemistry*, 46(4):1233-1236 ("Chen"). Citing works by Seki, Zaworotko, Kim, and others (col. 2, p. 1233), Chen also describes the preparation of various pillared materials using hydrothermal reactions and commercially available reagents (col. 2, p. 1234, and col. 2, p. 1235). Again, Chen is further evidence that the skilled artisan would have been capable of practicing the methods and preparing the materials of the instant claims based on the teachings of the specification and the knowledge generally available to the skilled artisan.

Once the concept of gas adsorption is contemplated, modification and optimization of pillared materials is also within the grasp of the skilled artisan. This is evidenced by Mulfort et al. (2007) *J. Am. Chem. Soc.*, 129, 9604-9605 ("Mulfort"), which describes applying redox reactions to the framework of pillared materials in order to enhance hydrogen uptake. Mulfort is further evidence that the skilled artisan is capable of synthesizing and optimizing the pillared materials of the instant application using the teachings of the specification and the knowledge generally available to the skilled artisan.

The Action provides further comments on the rejection set forth in the Action dated 11/30/2006:

Applicants have admitted the method of making is old and known, with any optimization necessary well within the skill in the art. The Examiner will take Applicants at their word. however, given lack of direction provided by Applicants - among other factors noted in the non-final action of 11/30/2006 - the Examiner is of the position that the enablement rejection is still proper.

(Action at p.8, emphasis in original). First, and as discussed hereinabove, the implication that applicants have admitted that the claimed invention is old and known is a mischaracterization of

applicants' arguments. In fact, methods suitable for preparing the claimed compounds involve synthetic reactions that were well known in the art at the time the instant application was filed. For example, applicants again refer to Diederich, (1997) *Pure & Appl. Chem.*, **69**(3):395-400, which demonstrates that Diels Alder reactions occur readily with the fullerene allotrope. Other useful reactions (such as the ligation and hydrothermal reactions mentioned in the references described above) were also generally known to the skilled artisan at the time the instant application was filed. The skilled artisan was capable of applying such reactions to the methodologies and materials described in the instant claims using the guidance provided in the specification as well as commonly available knowledge. Second, the Action accepts applicants' statement that synthetic procedures for preparing the claimed materials would involve optimization that is within the skill in the art. Given this, and in light of the additional arguments and evidence set forth herein, applicants maintain that the enablement requirement is satisfied by the original specification. There is not a "lack of direction" as mentioned in the Action; the application provides instructions for preparing the claimed materials, as well as citations to supporting references that could be used to assist in such preparation, and the skilled artisan is of course capable of supplementing such information with commonly available knowledge. The Examiner appears to be in agreement that the claimed materials could be synthesized by one of skill in the art (using the specification and commonly available knowledge), and that optimization is within the art. Accordingly, withdrawal of the non-enablement rejection is proper.

Overall, the references cited above indicate that the skilled artisan is capable of preparing and modifying a wide variety of pillared carbon materials using common synthetic procedures. Although the concept of the claimed subject matter (i.e., pillared carbon materials doped with a metal) is novel and non-obvious, the specific synthetic reactions useful in preparing such materials are not unusual. Thus, armed with the teachings of the instant specification and the knowledge generally available, the skilled artisan would be capable of preparing the claimed compositions and practicing the claimed methods. Accordingly, applicants respectfully request withdrawal of the rejection.

Rejection under 35 U.S.C. §112, first paragraph

Claims 1-36 stand rejected under 35 U.S.C. §112, first paragraph, as "failing to comply with the written description requirement" (Action at page 2). This rejection is traversed.

The four references described above also provide evidence that the instant specification provides sufficient written description for the instant claims. In particular, the articles provide evidence that the skilled artisan understands the concept of "pillared" carbon materials. Furthermore, the articles show that the skilled artisan is capable of applying well known synthetic reactions (e.g., ligation reactions, solvothermal reactions, etc.) to create pillared carbon materials as described in the claims. The application provides sufficient written description to demonstrate to the skilled artisan that applicants were in possession of the claimed subject matter - i.e., pillared carbon materials doped with a metal and methods of preparing hydrogen storage compositions.

The Action's arguments pertaining to the adequacy of drawings and "other descriptions" (Action at pp. 6-7) loses sight of the true inquiry relevant to written description - i.e., whether the claimed invention is described sufficiently such that the skilled artisan can reasonably conclude that the inventor had possession of the claimed invention. See MPEP § 2163(I). Quite often in chemistry, the inventive aspect of a novel material is largely or wholly contained within the idea for the material itself. Once the idea for the material has been conceived, preparation of the material is simply a matter of routine chemical experimentation using well-known reactions. In the instant case, the computational results describing the claimed materials are sufficient to lead the skilled artisan to conclude that applicants were in possession of such materials. The experimental details necessary for preparation of the materials may be derived by routine experimentation, and the skilled artisan would have recognized this fact from the specification.

With regard to the lack of working examples in the specification, the Action states that "[a]pplicants stand in a field of doubt, speculation, and controversy" (Action at 7). There is hardly a subject in chemistry that does not elicit speculation and controversy among those practitioners intimately involved at the forefront of research relevant to that topic. Where skilled artisans are capable of actually making the controversial materials, controversy and speculation over extrinsic matters such as the accuracy of various computer models is not sufficient to question the adequacy of instructions for making and using such materials. This is the case for the instantly claimed pillared carbon materials, and the references cited hereinabove are just a

few examples that show the ability of the skilled artisan to carry out known reactions in order to arrive at such materials.

In the rejection as set forth in the previous Action, the Examiner stated that “[a]pplicants have done little more than run a computer simulation... There is nothing in the Applicants’ specification to suggest that Applicants have made a composition described in [the] Claims...” Applicants reiterate that a lack of working examples does not preclude satisfaction of the written description requirement; the simple fact that no real-life examples are included in the specification is not sufficient by itself to question the adequacy of the description in the application. As described in MPEP §2163.04, it is the Examiner’s task to present a preponderance of evidence to challenge the adequacy of the written description

A description as filed is presumed to be adequate, unless or until sufficient evidence or reasoning to the contrary has been presented by the examiner to rebut the presumption. See, e.g., *In re Marzocchi*, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971). The examiner, therefore, must have a reasonable basis to challenge the adequacy of the written description. The examiner has the initial burden of presenting by a preponderance of evidence why a person skilled in the art would not recognize in an applicant’s disclosure a description of the invention defined by the claims. *Wertheim*, 541 F.2d at 263, 191 USPQ at 97.

The Examiner has yet to present “by a preponderance of evidence” reasons for questioning the adequacy of written description provided in the application.

It should also be noted that recently reported computational results have provided further evidence that the models used with pillared carbon materials are effective and accurate predictors of experimental results. See, for example, column 2 on page 8422 of Han et al. (2007), *J. Am. Chem. Soc.*, 129, 8422-8423.

Based on the evidence presented in the references cited herein (including those cited above in the discussion pertaining to enablement of the claims), the skilled artisan would have recognized that actual syntheses of pillared carbon materials are not necessary for the specification to demonstrate possession of the claimed subject matter. In particular, the details provided, *inter alia*, in paragraphs [00037]-[00045] of the specification are sufficient for the skilled artisan to understand that applicants were in possession of the claimed compositions and methods at the time the application was made. Accordingly, applicants respectfully request withdrawal of the rejection.

Rejection under 35 U.S.C. §103(a)

Claims 1, 4-6, 11, 13-18, 21-25, 27, 32, and 36 stand rejected under 35 U.S.C. §103(a) as unpatentable over Rodriguez in view of Inagaki. This rejection is traversed.

In the previous Action, the Examiner cites Rodriguez as describing layered carbon compositions, and Inagaki as describing the intercalation of carbon materials with an organic ligand (Action dated 11/30/2006 at p. 11). Based on the Examiner's claim construction, the Action asserts that the skilled artisan would be motivated to modify the materials of Rodriguez using the "intercalation reaction" described by Inagaki.

As stated in applicants' May 23 response, the claim construction provided in the Action dated 11/30/2006 is not an accurate representation of applicants' express definition of the term "pillared." Nevertheless, and without acquiescing to the Examiner's claim construction arguments, applicants have amended claim 1 to incorporate elements of the express definition from the specification. It is now particularly evident that the intercalated materials of Inagaki are not pillared carbon materials as claimed in amended claim 1. Claim 1 specifically refers to carbon materials comprising pillared materials separating carbon material parts, which would be expected to be more stable than analogous intercalated compounds such as those in Inagaki. For example, mechanical milling destroys the intercalated structure of an intercalated compound, whereas the pillared carbon materials of the present invention would be expected to maintain the pillared structure upon mechanical milling. For at least these reasons, the teachings of Inagaki and Rodriguez do not obviate the pending claims, and withdrawal of the rejection is respectfully requested.

Rejection under 35 U.S.C. §103(a)

Claim 26 stands rejected under 35 U.S.C. §103(a) as unpatentable over Rodriguez in view of Inagaki and further in view of Janot. This rejection is traversed.

The Action dated 11/30/2006 states that Rodriguez does not disclose ball milling, but that Janot provides the missing teaching. Regardless of whether Janot teaches ball milling, however, the combination of Rodriguez in view of Inagaki does not teach the preparation of the claimed pillared carbon materials (see discussion above). For example, neither Rodriguez nor Inagaki teach preparing a carbon material with a structure that is stable to mechanical milling. Nor does

Rodriguez or Inagaki teach carrying out a reaction between a carbon material and organic ligands intercalated therein. Janot also does not teach carrying out a reaction between a carbon material and organic ligands intercalated therein. Accordingly, Janot does not provide the teachings missing from the combination of Rodriguez and Inagaki. Applicants respectfully request withdrawal of the rejection.

Rejection under 35 U.S.C. §103(a)

Claims 2-3, 8, 19-20, 29, and 34-35 stand rejected under 35 U.S.C. §103(a) as unpatentable over Rodriguez in view of Inagaki and further in view of Chen. This rejection is traversed.

The Action dated 11/30/2006 states that the limitations set forth in the rejected claims (i.e., doping with alkali metals - claims 2-3 and 19-20; various ratios of metal to carbon atoms - claims 8 and 29; and various uses of the compositions - claims 34-35) are not found in the combination of Rodriguez with Inagaki. Regardless of whether Chen provides the additional limitations, however, the combination of Rodriguez in view of Inagaki does not teach the preparation of the claimed pillared carbon materials (see discussion above). For example, neither Rodriguez nor Inagaki teach preparing a carbon material with a structure that is stable to mechanical milling. Nor does Rodriguez or Inagaki teach carrying out a reaction between a carbon material and organic ligands intercalated therein. Chen also does not teach carrying out a reaction between a carbon material and organic ligands intercalated therein. Accordingly, Chen does not provide the teachings missing from the combination of Rodriguez and Inagaki. Furthermore, applicants note that the results in Chen were later found to be “due to the impurity water gain/loss present in the hydrogen feedstream rather than to H₂ itself” - see col. 1 of the first page of the PRL article. This provides further evidence that the skilled artisan would not have looked to Chen to provide the teachings missing from Rodriguez and Inagaki. Applicants respectfully request withdrawal of the rejection.

Claim objections

The Action dated 11/30/2006 stated that claims 7, 9-10, 12, 28, 30-31, and 33 are objected to for depending upon a claim that has been rejected. With the arguments set forth

herein, applicants submit that claims 1-6, 8, 11, 13-27, 29, 23, and 34-36 are allowable. The objection to the claims is therefore overcome.

CONCLUSION

Applicants submit that the claims of the application are in condition for allowance. Applicants respectfully request withdrawal of the rejections, and prompt issuance of a notice of allowance. If the Examiner has any questions concerning this communication, or would like to discuss the application, the art, or other pertinent matters, a telephone call to the undersigned would be welcomed.

Respectfully submitted,

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